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# ISO-DAM8A

*Modules Isolated Low Noise Bio-Amplifer*

www.wpiinc.com

# INSTRUCTION MANUAL

Serial No._____

030912

***World Precision Instruments***

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# ABOUT THIS MANUAL

The following symbols are used in this guide:

This symbol indicates a CAUTION. Cautions warn against actions that can cause damage to equipment. Please read these carefully.

This symbol indicates a WARNING. Warnings alert you to actions that can cause personal injury or pose a physical threat. Please read these carefully.

NOTES and TIPS contain helpful information.




*Fig. 1—Up to eight rackmountable ISO-DAM8A and Bridge8 modules can be combined in a single chassis.*

# INTRODUCTION

The Iso-DAM8A is a modular bioamplifer designed for use with the Iso-DAM8 chassis, which can accommodate up to 8 modules. The Iso-DAM8A input stage is differential and is isolated from the AC power system. For example, there is no electrical connection to the AC power circuit ground. Isolated pre-amplification has important advantages over non-isolated amplifiers:

- There is no significant current can flow from the preamplifier input terminals to ground. Therefore, input connectors are intrinsically safe and cannot cause electrical shock at the site of measurement.
- Problems caused by "ground loops" are eliminated.

Electrodes or other signal sources may be connected directly to the Iso-DAM8A input connector, or an optional active headstage (WPI Part **#74040)** may be used. The headstage connects to the Iso-DAM8A through a 5-foot cable. It contains a high impedance differential amplifier in a small metal housing. Electrodes may be connected directly to the headstage, which can be positioned at the measurement site, minimizing electrical noise pickup and stray capacitance.

The Iso-DAM8A module contains an input DC offset adjustment, switch-selectable gain, switch-selectable high pass and low pass filters, a line frequency "notch filter" (which can be set to 50 or 60 Hz), and an output DC position adjustment.

The Iso-DAM8 chassis can be ordered for either 110-120VAC or 220-240VAC operation. The chassis can accommodate up to eight Iso-DAM8A bioamplifiers. A separate BNC connector is provided for the output of each channel, and all channel outputs are available at a common DB-25 connector.

## Notes and Warnings

**CAUTION**: The inputs to the Iso-DAM8A and the headstage can be damaged by electrostatic discharge. We recommend that you momentarily touch the Iso-DAM8A chassis or any grounded metal object before connecting wire or electrodes to the inputs.

## Unpacking

Upon receipt of this instrument, make a thorough inspection of the contents and check for possible damage. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed damage should be reported at once to the carrier and an inspection requested. Please read the section entitled "Claims and Returns" on page 11 of this manual. Please contact WPI Customer Service if any parts are missing at 941.371.1003 or customerservice@wpiinc.com.

**Returns:** Do not return any goods to WPI without obtaining prior approval (RMA # required) and instructions from WPI's Returns Department. Goods returned (unauthorized) by collect freight may be refused. If a return shipment is necessary, use the original container, if possible. If the original container is not available, use a

suitable substitute that is rigid and of adequate size. Wrap the instrument in paper or plastic surrounded with at least 100mm (four inches) of shock absorbing material. For further details, please read the section entitled "Claims and Returns" on page 11 of this manual.

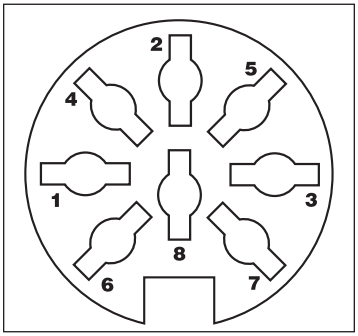
# INSTRUMENT DESCRIPTION

## Noise and Interference

Electrical noise and interference originating from the current and voltage in the power mains and room lighting power is a primary source of concern for low level bioelectric recording. Every high amplification preamplifier is subject to this handicap, particularly when using microelectrodes. We recommend that all input leads be shielded and the preparation connected to earth (ground). Often, it will be necessary to enclose the preparation and electrode lead wires in a Faraday cage or shield to reduce mains induction to sufficiently low levels. It may be beneficial to extinguish overhead fluorescent lighting, as well. *Use of the optional headstage preamplifier can vastly improve frequency response and reduce noise pickup when high-impedance electrodes are used!*

## Input Connection

The input connector of the Iso-DAM8A module is a 8-pin DIN connector. The pin designations are shown in **Fig. 2** and the function of each pin is shown in the following table.




| PIN | FUNCTION |
|---|---|
| 1 | Output from remote headstage. |
| 2** | Isolated Ground |
| 3 | Reference Connection (See instructions) |
| 4 | Direct Input (+) |
| 5 | Direct Input (–) |
| 6* | Headstage Power (+10VDC) |
| 7* | Headstage Power (–10VDC) |
| 8 | No connection |

*Fig. 2—Iso-DAM8A input connections are labeled.*

*Reserved for headstage use only. Do not use to power other devices.
**Must be used to reference + input and – input.

## Input Cable

For convenience of connection to signal sources, each Iso-DAM8A module is supplied with a 5-foot length of shielded input cable. One end is terminated in a DIN plug which mates with the module. The other end has unterminated tinned leads. The wires are color-coded as shown below:

| | |
|---|---|
| Red | + Input |
| Black | – Input |
| White | Isolated Ground"" |

## Source Select Switch

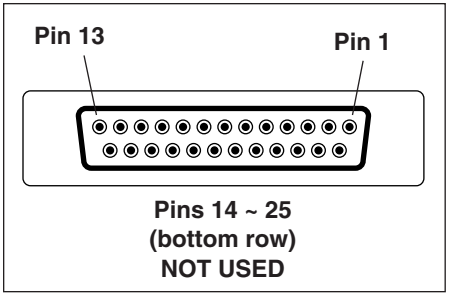
The Source Select Switch sets the unit to operate either in the Internal Amplifier (direct input mode) or the External Probe mode. When set to the Internal Amplifier (INT), electrodes or other signal sources are connected directly to the INPUT connector. When set to the PROBE position, the unit works with the optional headstage. A center GND position disconnects all inputs to permit you to establish a DC baseline with the POSITION control. Note that in this position, the DC OFFSET and BAL (balance) adjustments have no effect.

## Balance Adjustment

The DC balance potentiometer let you adjust the Gain switch position stability. This potentiometer is accessible through a small screwdriver hole on the front panel. To adjust the DC balance, connect the "+" and "-" inputs of the input connector, or the headstage, if used, to Isolated Ground. Set the GAIN switch to 10. Using an oscilloscope or recorder connected to the Output connector, adjust the POSITION control so that the output trace on the recorder or oscilloscope is near the zero volt level. Rotate the GAIN selector switch from x10 to x10000. If the baseline moves, readjust the DC Balance potentiometer at the x10000 setting with a small screwdriver until the baseline returns its prior setting. The baseline should not deflect appreciably when the GAIN switch is reduced to lower values. The baseline should remain essentially stable (with input grounded) as the Gain switch is rotated.

## Output

The maximum signal output from any preamplifier channel is ±10V. All preamplifier channels have individual coaxial (BNC) connectors on the rear panel of the instrument. Channel numbers start with #1 on the left hand side (front view). Channel outputs are also available on a 25-pin connector for use with data acquisition systems.




| PIN | FUNCTION | PIN | FUNCTION |
|---|---|---|---|
| 1 | Channel 1 | 8 | Channel 8 |
| 2 | Channel 2 | 9 | Ground |
| 3 | Channel 3 | 10 | Ground |
| 4 | Channel 4 | 11 | Ground |
| 5 | Channel 5 | 12 | Ground |
| 6 | Channel 6 | 13 | Ground |
| 7 | Channel 7 | | |

*Fig. 3—The 25-pin connector is used with data acquisition systems.*

## Filters

Iso-DAM8A provides selected filtering at both the high and low ends of its frequency spectrum. The Low Filter settings are DC, 0.1, 1, 10 and 300Hz. The High Filter settings are 100, 500Hz, 1kHz, 3kHz, and 10kHz. Typical settings recommended for ECG and EEG would be Low Filter at 0.1Hz and the High Filter at 0.1kHz (100Hz).

## DC Offset

When operating the Iso-DAM8A as a DC amplifier, you may require a DC offset potential to compensate any existing DC voltage from the recording site. The DC Offset knob can provide 0 to >100mV DC of either polarity to reduce (null) the net input signal to zero volts. This becomes increasingly necessary if high gains are to be used with DC amplification. The toggle switch below the DC Offset knob selects the polarity of the offset voltage. If offset adjustment is not required, the toggle switch is kept in the Off position.

## Single Channel Installation

1. Remove two screws on the right and left sides of the instrument enclosure, respectively. Then remove eight screws on the bottom of the enclosure.
2. Slide the internal chassis out of the enclosure.
3. Remove the two screws holding the blank panel where the new channel is to be installed.
4. Plug the connector of this channel into the new module, and secure the channel in position with two screws.
5. Slide the chassis into the enclosure and reinstall all the screws.

# OPERATING INSTRUCTIONS

The connection to and from the amplifier and the settings of the controls will vary greatly from one application to another. The following guidelines may be helpful in establishing initial operating conditions.

## Input Connections

**CAUTION**: The inputs to the Iso-DAM8A and the headstage can be damaged by electrostatic discharge. We recommend that you momentarily touch the Iso-DAM8A chassis or any grounded metal object before connecting wire or electrodes to the inputs.

It is very important to minimize input lead length, and use of shielded cable is recommended for any leads over 2 or 3 inches (except grounding leads). Both the inverting and non-inverting inputs must be connected. A "floating" (non-connected) input will cause amplifier saturation.

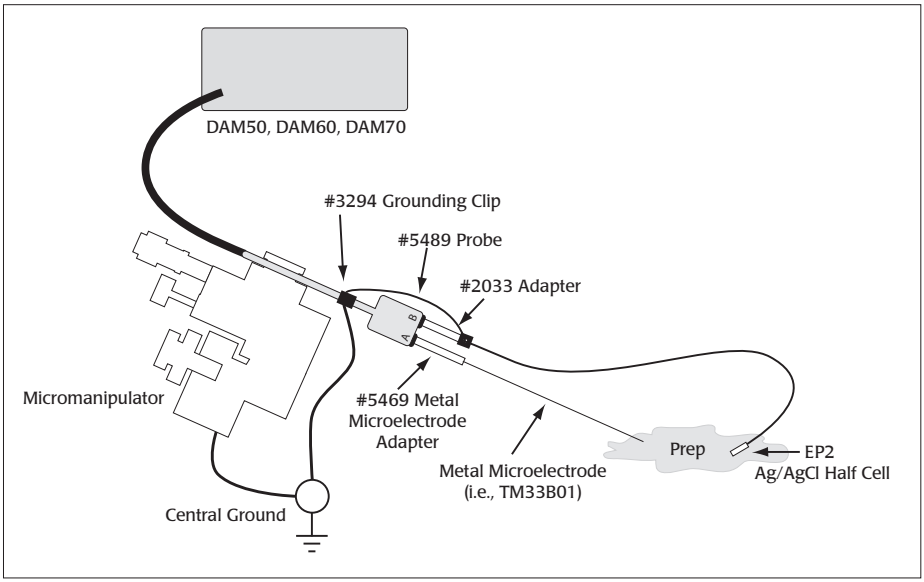



*Fig. 4—A typical single-ended configuration is shown here.*

The Iso-DAM8A inputs can be connected in either differential or single-ended modes. Differential connection can reduce noise pickup, and is usually preferable to single-ended. **Fig. 4** shows a typical single-ended configuration. The optional remote headstage is shown in these examples.

The two inputs on the headstage are electrically identical, except that positive-going signals applied to the RED non-inverting input produce a positive-going output from

the Iso-DAM8A, whereas a positive-going signal applied to the BLACK inverting input produces a negative-going output. The same holds true for the non-inverting "+" input and inverting "–" input on the INPUT connector. Reversing the connections from that shown simply results in an inverted signal.

## Output Connections

The output from each Iso-DAM8A module is available on the rear panel from a standard BNC connector or all channels are available at the 25-pin connector. See Fig. 3 for pin designations. The Iso-DAM8A output is suitable for application to any recording or data acquisition device.

## Grounding

Proper grounding is critical to successful biological signal monitoring. The optimum grounding configuration is the "single-point ground," in which each component of a monitoring setup is connected to a single point which is connected to earth or mains ground. This grounding configuration is used in **Fig. 3 and Fig. 4.**

## Shielding

The isolation feature of the Iso-DAM8A minimizes, but cannot eliminate, noise pickup from electric distribution lines, fluorescent lights, computers, motors, radio frequency transmitters, microwave ovens, etc. Use of shielded wires for input connection is necessary if the subject is located more than a few inches from the amplifier inputs. Even the use of shielded wires and proper grounding may be insufficient in a high electrical noise environment, particularly if high impedance electrodes are used, if the signal level is low (less than 100mV or so), or if high frequency response is required. In these situations, the use of a metal shield, known as a Faraday cage, which encloses the subject and the headstage may be necessary.

## Idle Settings

If you are not certain what settings are required, the following settings are a good starting point:

PROBE SELECT: GND
LOW FILTER: DC
DC OFFSET: OFF
GAIN: 10
HIGH FILTER: 10 kHZ
NOTCH FILTER: OFF
POSITION: Mid-range
POWER: OFF

## Control Adjustment

After connecting inputs and outputs, the amplifier can be turned on. The POSITION control may be used to establish a baseline setting on the recording device. It is

normal to set this control so that the recording device indicates zero when the PROBE SELECT is in the GND position. The PROBE SELECT switch should be set appropriately for the setup.

- If the headstage is used, set the switch to PROBE.
- If direct connection is made to the Iso-DAM8A input, set the switch to INT.

The GAIN control should be set so that the desired signal produces a significant (>30% of full scale or so) on the recording device. If the recording device has a gain or sensitivity control, it is usually preferable to set the recording device to a low gain and the Iso-DAM8A to a high gain.

The HIGH and LOW filters should be used to reject noise outside the signal frequency range. If the signal is transient in nature and DC response is not required, the LOW filter should be set to the highest setting that does not distort the signal. The HIGH filter should be set to the lowest setting that does not distort the signal.

If line noise is a problem, the NOTCH FILTER may be set to 50 or 60Hz, as appropriate for the power system. Use of the notch filter can severely distort some signals.

If a large DC offset is present in the setup, the DC OFFSET control can be used to cancel it. The setting of this control can be quite sensitive, especially at high gain settings.

# SPECIFICATIONS

This unit conforms to the following specifications:

Voltage Gain ..... x10, x100, x1000, x10,000
Input Impedance to Gnd, each input ..... > $10^{12}\Omega$ DC, 5 picofarads (typical)
Input R, Between Inputs ..... >$10^{12}\Omega$ DC, 3 picofarads (typical)
Amp Noise, Input Shorted ..... < 0.2µV rms (1-100Hz),
..... < 1µV rms (1-10kHz)
Bandwidth ..... DC to 10kHz
High Filter (Low Pass) ..... 0.1, 0.5, 1, 3, 10kHz
Low Filter (High Pass) ..... 0.1, 1, 10, 300Hz
Input Offset Voltage Adjust. ..... ± 1VDC
Common Mode Rejection ..... > 100dB @ 50/60Hz with <10Ω source
..... 70dB typical with balanced 1MΩ source
Notch Filter Settings ..... 50Hz, 60HZ, Off
Line Noise Rejection ..... >40dB
Output Voltage Swing ..... ±10V Maximum
Output Resistance ..... 200Ω
Output Position Adjustment ..... ±1VDC
Power Source ..... Power Adapter 110-120V/60Hz or 220-240/50Hz
Enclosure Dimensions ..... 6.8 x 17 x 11.2˝ (17 x 43 x 28cm)
Shipping Weight ..... 10–21 lb. (4.5–9.5kg)

# WARRANTY

WPI (World Precision Instruments, Inc.) warrants to the original purchaser that this equipment, including its components and parts, shall be free from defects in material and workmanship for a period of one year* from the date of receipt. WPI's obligation under this warranty shall be limited to repair or replacement, at WPI's option, of the equipment or defective components or parts upon receipt thereof f.o.b. WPI, Sarasota, Florida U.S.A. Return of a repaired instrument shall be f.o.b. Sarasota.

The above warranty is contingent upon normal usage and does not cover products which have been modified without WPI's approval or which have been subjected to unusual physical or electrical stress or on which the original identification marks have been removed or altered. The above warranty will not apply if adjustment, repair or parts replacement is required because of accident, neglect, misuse, failure of electric power, air conditioning, humidity control, or causes other than normal and ordinary usage.

To the extent that any of its equipment is furnished by a manufacturer other than WPI, the foregoing warranty shall be applicable only to the extent of the warranty furnished by such other manufacturer. This warranty will not apply to appearance terms, such as knobs, handles, dials or the like.

WPI makes no warranty of any kind, express or implied or statutory, including without limitation any warranties of merchantability and/or fitness for a particular purpose. WPI shall not be liable for any damages, whether direct, indirect, special or consequential arising from a failure of this product to operate in the manner desired by the user. WPI shall not be liable for any damage to data or property that may be caused directly or indirectly by use of this product.

## Claims and Returns

Inspect all shipments upon receipt. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed loss or damage should be reported at once to the carrier and an inspection requested. All claims for shortage or damage must be made within ten (10) days after receipt of shipment. Claims for lost shipments must be made within thirty (30) days of receipt of invoice or other notification of shipment. Please save damaged or pilfered cartons until claim is settled. In some instances, photographic documentation may be required. Some items are time-sensitive; WPI assumes no extended warranty or any liability for use beyond the date specified on the container

Do not return any goods to us without obtaining prior approval and instructions from our Returns Department. Goods returned (unauthorized) by collect freight may be refused. Goods accepted for restocking will be exchanged or credited to your WPI account. Goods returned which were ordered by customers in error are subject to a 25% restocking charge. Equipment which was built as a special order cannot be returned.

## Repairs

Contact our Customer Service Department for assistance in the repair of apparatus. Do not return goods until instructions have been received. Returned items must be securely packed to prevent further damage in transit. The Customer is responsible for paying shipping expenses, including adequate insurance on all items returned for repairs. Identification of the item(s) by model number, name, as well as complete description of the difficulties experienced should be written on the repair purchase order and on a tag attached to the item.

** Electrodes, batteries and other consumable parts are warranted for 30 days only from the date on which the customer receives these items.*

## *World Precision Instruments, Inc.*

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